



Status of HQ Analyses for DOE Spent Nuclear Fuel

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October 20, 2004

Outline

- ❖ Strategy for accommodating DOE SNF and other candidate materials in a geologic repository
- ❖ Use of expert judgement
- ❖ Method for determining relative attractiveness to theft of DOE SNF
- ❖ Overall results from workshops, including extended analyses

Commercial SNF Reference

- ❖ CSNF is the reference for assessing relative attractiveness
- ❖ NRC's Regulation, 10CFR73.51, prescribes requirements for physical protection of CSNF and HLW in a licensed geologic repository
- ❖ Approach is to evaluate attractiveness of all candidate materials relative to the CSNF benchmark

Expert Judgement

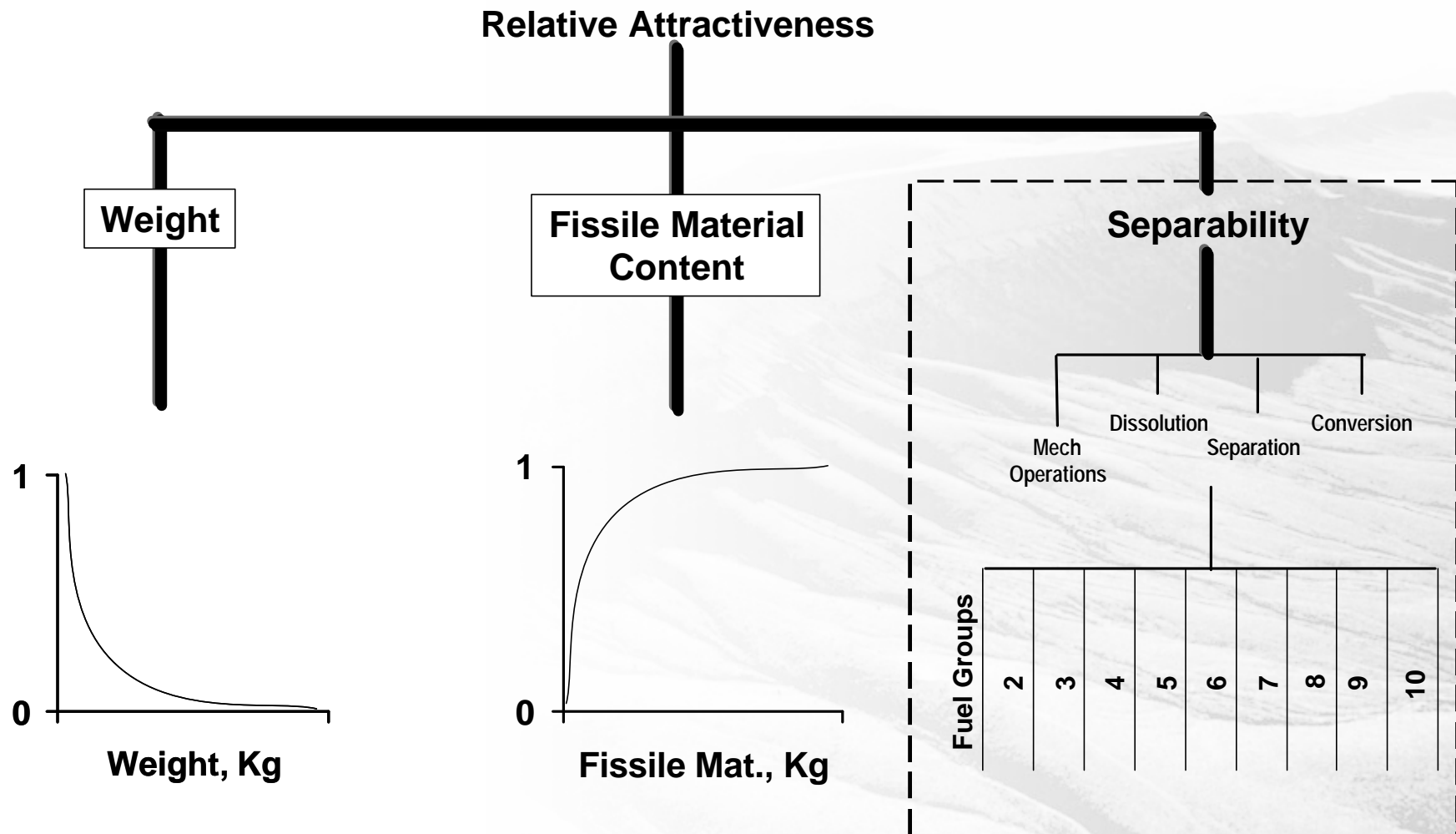
- ❖ **Formal Elicitation of Expert Opinion and Aggregation of Multiple Opinions**
- ❖ **Documentation of Elicitation Process and Rationale of Subject Matter Experts**
- ❖ **Subject Matter Experts Should Confirm that the Documentation is Adequately Capturing their Opinions**

Intrinsic Characteristics

❖ Three intrinsic characteristics affect relative attractiveness:

- Weight
- Fissile Material Content
- Relative Difficulty of Separation
 - Includes homogeneity and concentration of special nuclear material

Structure for Determining Relative Attractiveness of DOE Spent Nuclear Fuel



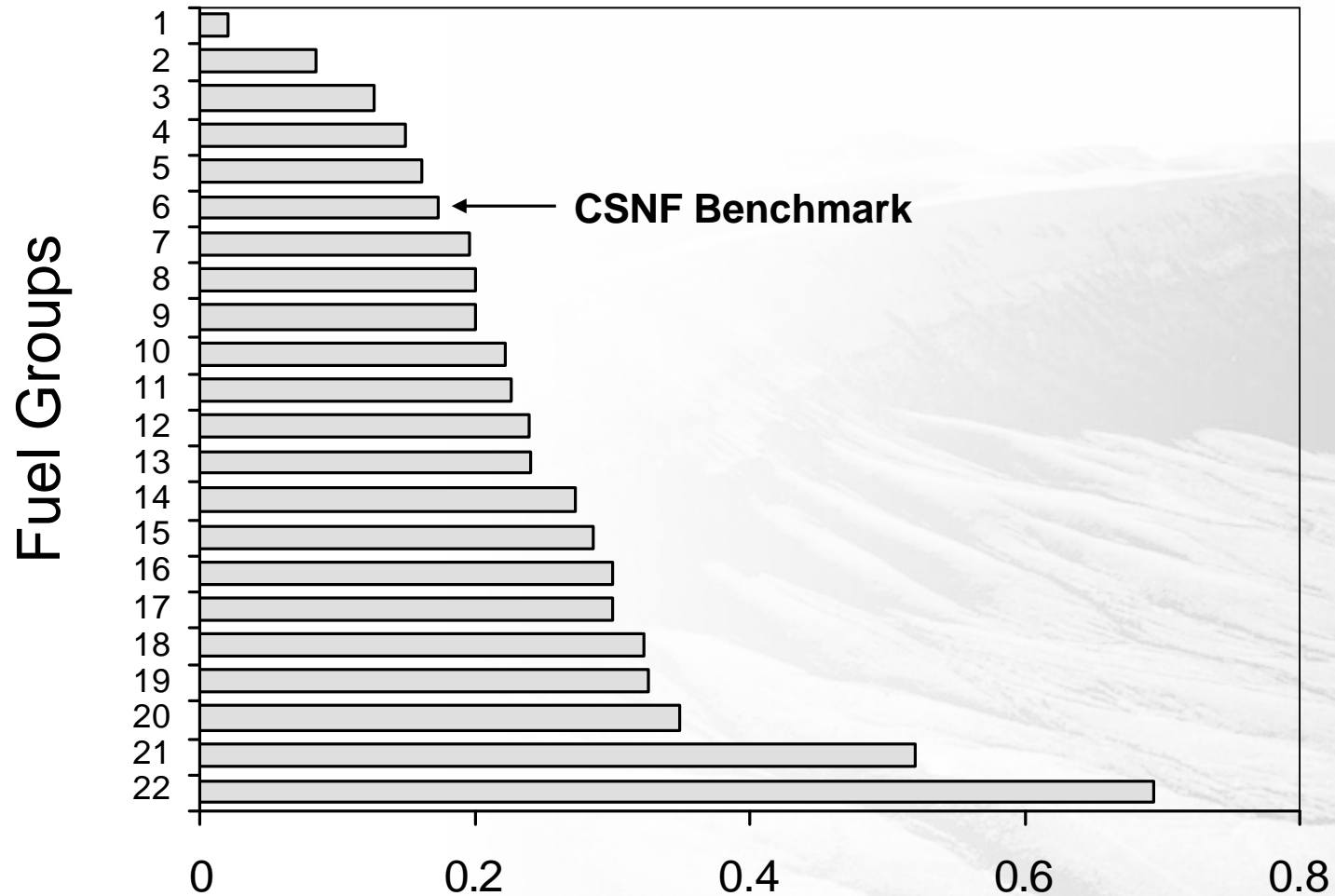
Separability: Workshop 1 (August 2001, SNL)

- ❖ Define a Reference Process for Separating Special Nuclear Material from CSNF
- ❖ Group Fuels Based on Separability Characteristics Relative to Recovery of Fissile Material
- ❖ Select Representative Fuel from Each Group
- ❖ Determine Separation Process Steps
- ❖ Weigh Relative Importance of Each Stage of Process
- ❖ Rate Relative Difficulty of Each Process Step for Each Fuel Type Compared to CSNF

Subject Matter Expert Team for Workshop #1 on Chemical Separability

Name	Affiliation, Selected Experience
John Ackerman	<u>Argonne National Lab.</u> , Pyroprocessing of oxide and metallic SNF
Denny Filmore	<u>INEEL</u> , Reprocessing chemistry for recovery of SNM
Leroy Lewis	<u>INEEL</u> , Development chemistry for the Chemical Processing Plant
Mal McKibben	<u>Savannah River Site (ret.)</u> , SNF & isotopes processing
Chris Phillips	<u>British Nuclear Fuels Ltd.</u> , Processing engineering for nuclear fuel and waste separations
Wallace Schulz	<u>Hanford Site (ret.)</u> , Chemical engineering for nuclear fuel and waste separations
George Vandergrift	<u>Argonne National Lab.</u> , Separation processing and solution chemistry
Ray Wymer	<u>Oak Ridge National Lab. (ret.)</u> , R & D on all aspects of the nuclear fuel cycle

Separability Ranking of DOE Spent Nuclear Fuels



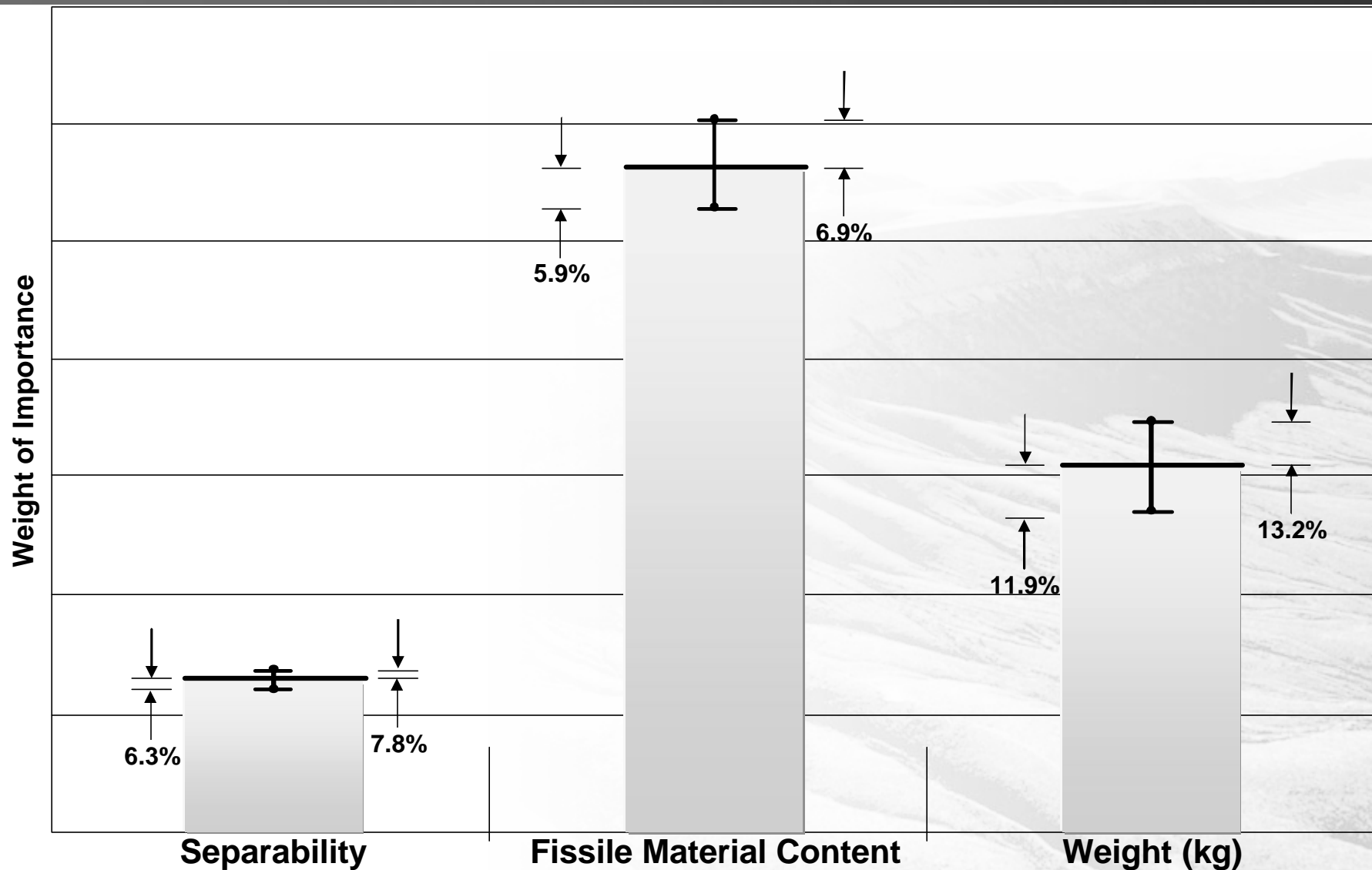
Ranking Attractiveness of DOE Fuels Relative to Commercial SNF: Workshop 2 (Jan. 2002, DC)

- ❖ Develop Relative Weights of Importance of the Three Attractiveness Attributes - Weight, Fissile Material Content, Separability
- ❖ Develop Utility Curves for Weight and Fissile Material Content
- ❖ Incorporate Separability Scores from Workshop 1
- ❖ Calculate Fuel Attractiveness to Theft Relative to CSNF

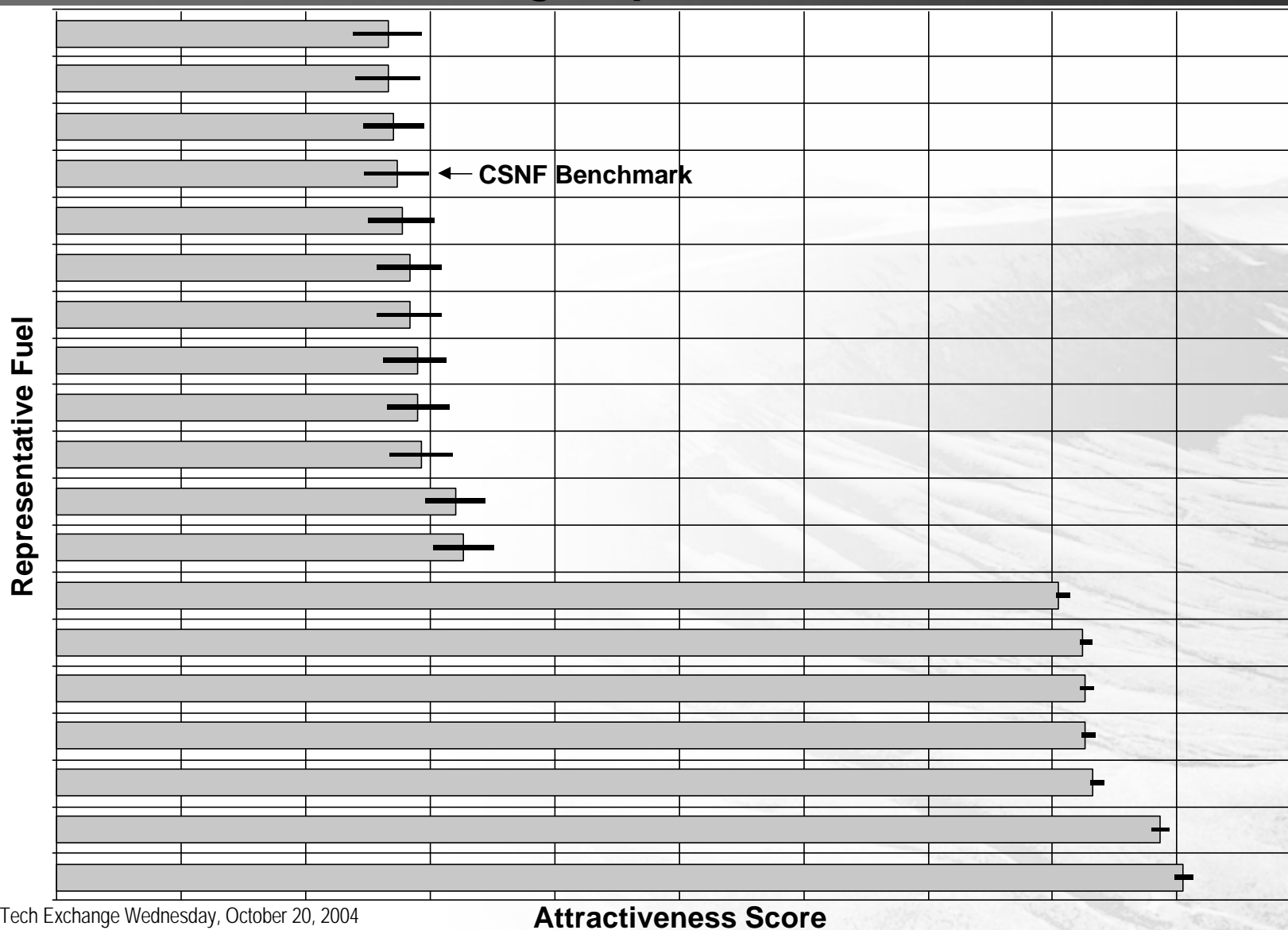
Subject Matter Expert Team for Workshop #2: Fuel Attractiveness and Safeguard Measures

Name	Affiliation, Selected Experience
Michael Bowman	Booz Allen, Physical security of NATO special weapons storage
Elizabeth Ten Eyck	ETE Consulting, Regulation of safeguards for physical protection of nuclear material
Ken Tuuri	DOE Idaho, Safeguard and security programs and licensing of the Idaho nuclear facilities
Ivan Waddoups	Sandia National Lab., Security analyses of US and Former Soviet Union nuclear facilities
Ray Wymer	Oak Ridge National Lab. (ret.), Non- proliferation in the nuclear fuel cycle
Steven Yonkoff	Science Application International, Vulnerability analyses of safeguard and security systems

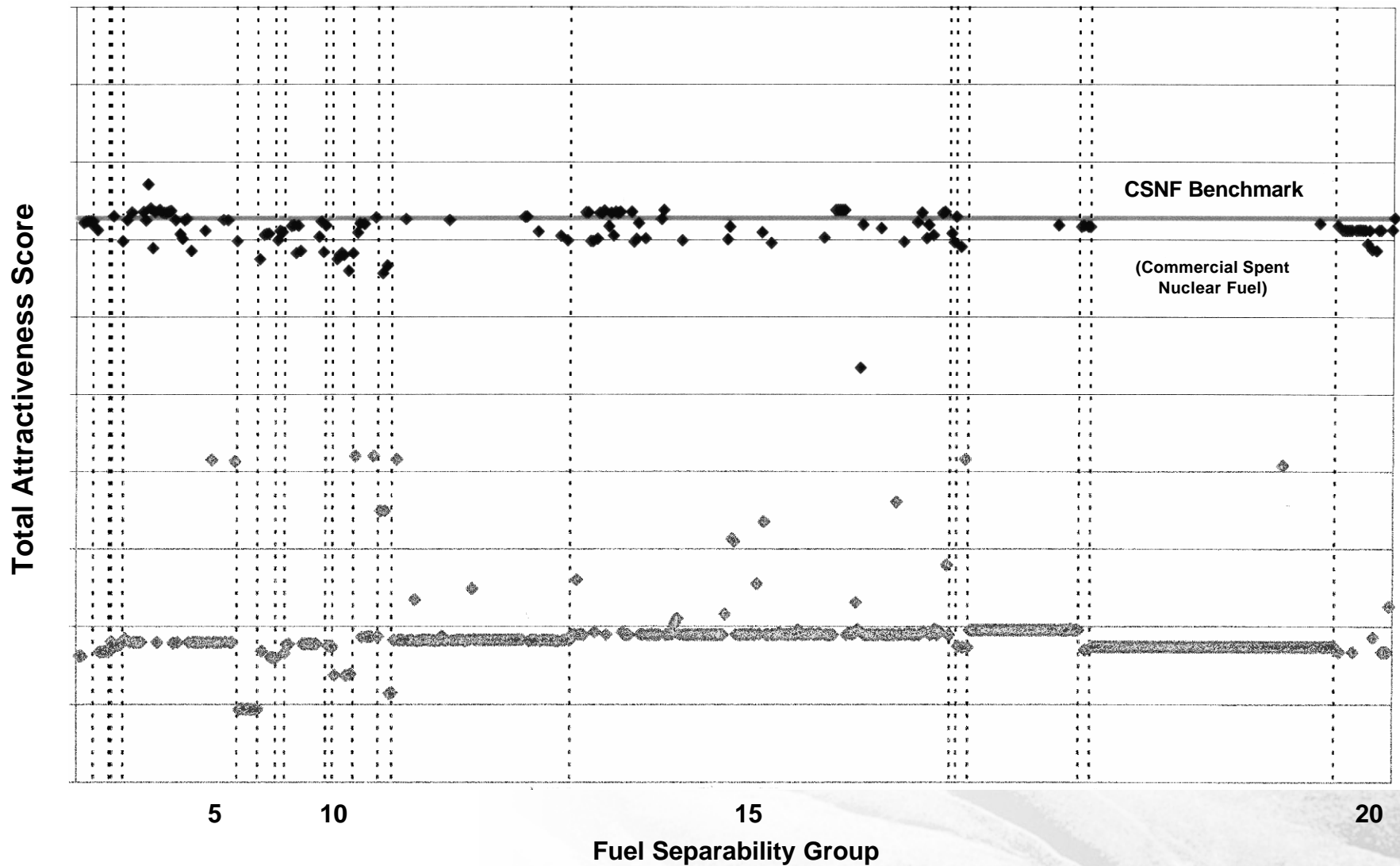
Relative Weights of Importance For Attractiveness Characteristics



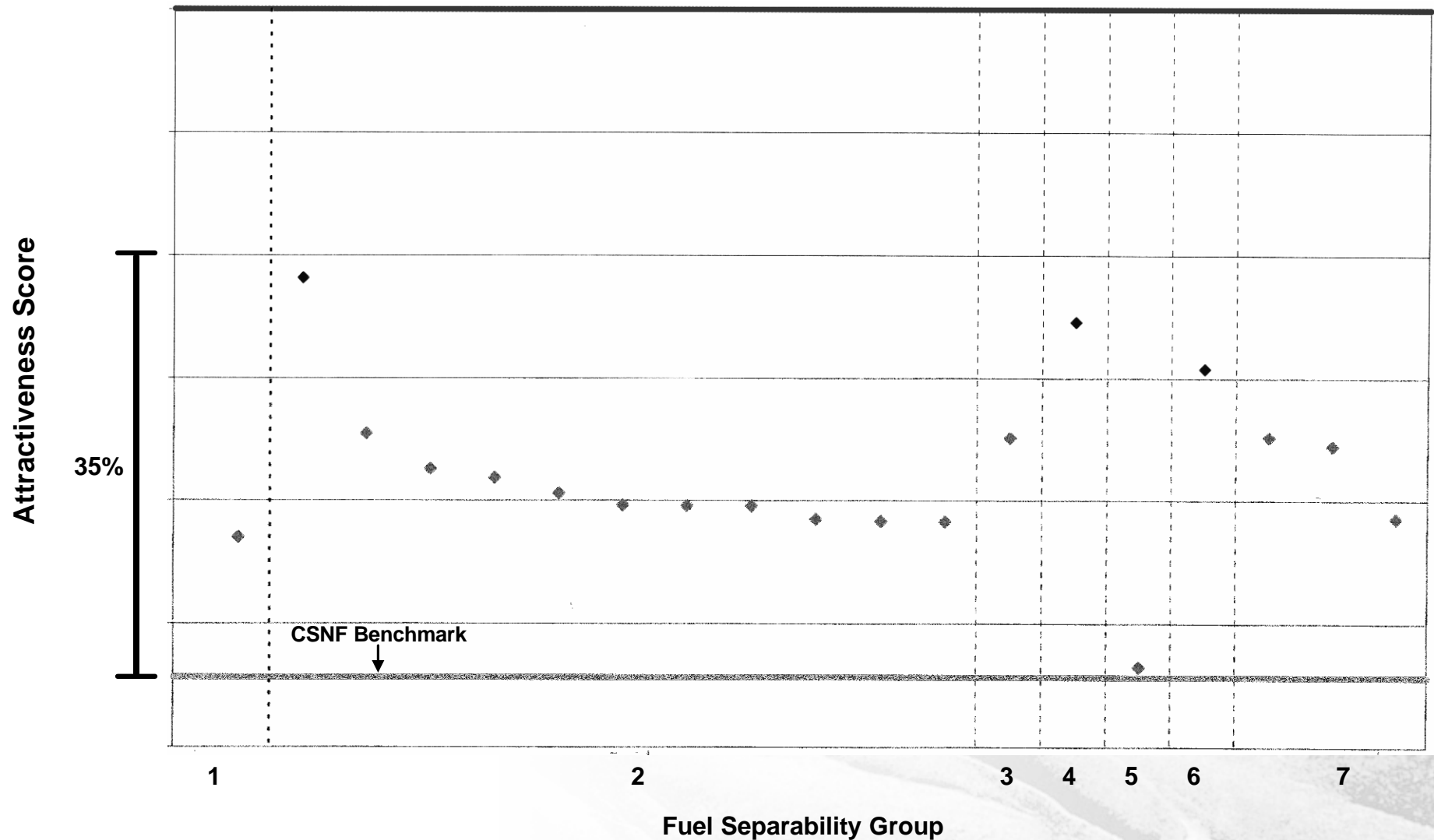
Relative Attractiveness Ranking of DOE SNF Using Representative Fuels



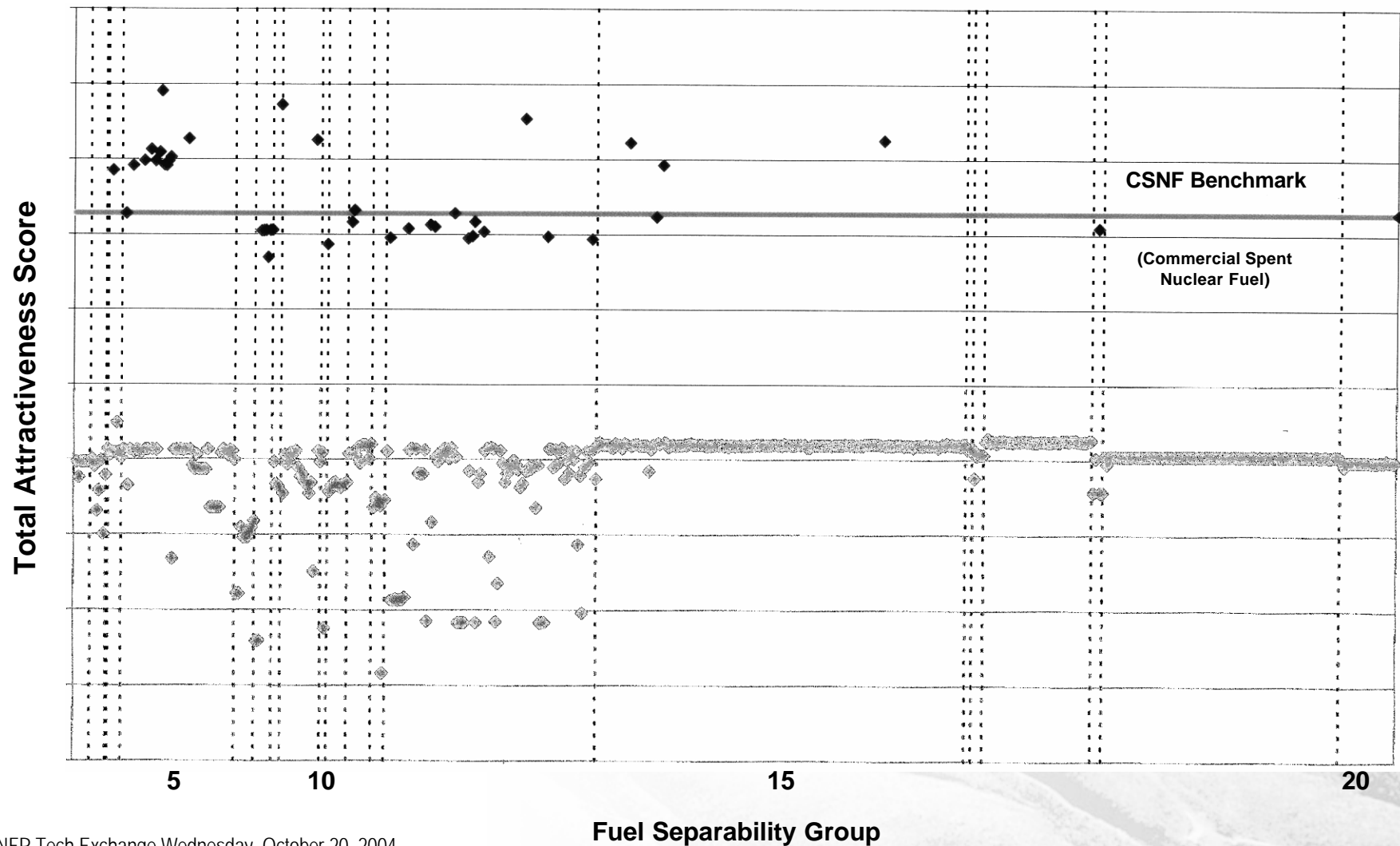
Attractiveness Score Versus Separability Group For The Spectrum of DOE SNF



Attractiveness Score Versus Separability Group For Relatively Attractive DOE SNF-Uncanistered



Attractiveness For DOE SNF By Fuel Group (Uncanistered Fuel)



Summary

- ❖ A model was developed to rank attractiveness to theft of DOE SNF and other candidate materials compared to CSNF
- ❖ Expert judgements from two workshops were integrated to determine attractiveness to theft of DOE SNF relative to CSNF
- ❖ No DOE SNF in standard canisters was significantly more attractive to theft than CSNF benchmark
- ❖ According to extended analyses, most uncanistered DOE SNF is no more attractive than CSNF benchmark